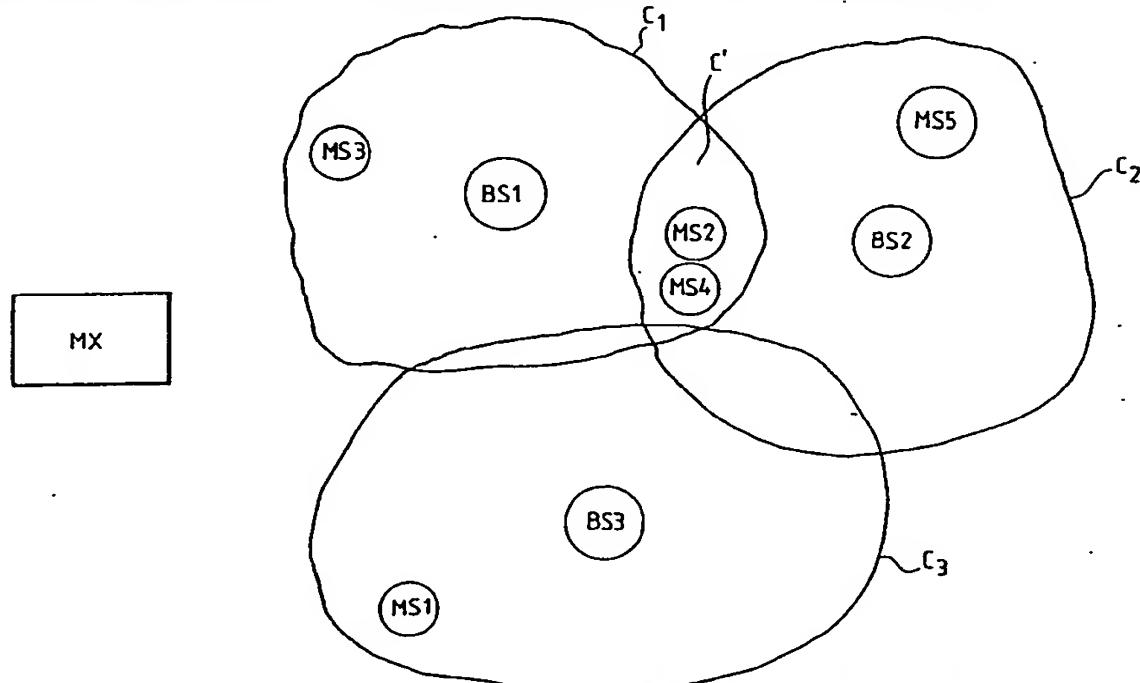




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : H04Q 7/02, H04B 7/26	A1	(11) International Publication Number: WO 93/05622 (43) International Publication Date: 18 March 1993 (18.03.93)
(21) International Application Number: PCT/FI92/00230		(81) Designated States: AU, DE, GB, JP, NL, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, SE).
(22) International Filing Date: 26 August 1992 (26.08.92)		
(30) Priority data: 914086 29 August 1991 (29.08.91) FI		Published <i>With international search report.</i>
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(54) Title: METHOD FOR SETTING UP A GROUP CALL IN A CELLULAR RADIO SYSTEM



(57) Abstract

The invention relates to a method for setting up a group call in a cellular radio system. The method comprises allocating a traffic channel to the group call and transmitting a group call paging message containing a traffic channel indication via each base station (BS1) whose radio cell (C1) resides in a predetermined operation area of the called group to the mobile radio stations (MS1-MS5) of the group. In order to ensure that all the mobile stations of the group roaming in the area participate in the group call, an additional group call paging message is transmitted via the base stations (BS2) of radio cells (C2) adjacent to said predetermined operation area to mobile radios (MS4, MSS) of the group. The additional group call paging message contains an instruction to switch to the allocated traffic channel of the radio cell (C1) residing in said operation area.

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Method for setting up a group call in a cellular radio system

Field of the Invention

5 The invention relates to a method for setting up a group call in a cellular radio system, said system comprising a plurality of radio cells with overlapping peripheral areas, each radio cell comprising a fixed radio station communicating by radio with mobile radio stations roaming in the system, the method comprising allocating a traffic channel to the group call and transmitting a group call paging message containing said traffic channel indication via each fixed radio station whose radio cell resides in a predetermined operation area of a called group to the mobile radio stations of the group.

Background of the Invention

A group call is a conference call in which all participants may talk in turn and hear one another. In group calls the whole group is called with a single dialled subscriber number, called a group number herein. An individual radio unit (e.g. mobile radio) may belong to a plurality of groups programmed into the radio unit. The system keeps a file on the base stations associated with the group number of each group. A group call may cover one, several or all base stations within the area of a mobile exchange or a plurality of mobile exchanges. In setting up a group call, a traffic channel is allocated from all base stations associated with the group, and each of these base stations transmits a group call paging message containing the group number and an indication of the allocated traffic channel. If the mobile radio identifies the group number contained in the group call paging message, it switches to the traffic channel indicated by the group call paging

message. Therefore, it is always possible for a mobile radio to join the group call if it is roaming in the predetermined operation area of the group.

In a mobile radio system operating on a cellular principle, adjacent base stations often have considerably overlapping coverage areas (radio cells). Mobile radios which are situated in a part of a coverage area shared by two base stations may use either one of the base stations. As regards a group call, the situation is problematic if one base station is located within the predetermined operation area of a given group and the other outside it. If a group call is set up in the overlapping area of such coverage areas, mobile radios of the same group may utilise different base stations, whereby only some of them join the group call, although in principle all are in the operation area reserved for the group.

Attempts have been made to solve this problem by setting up the group call just in case through more base stations than actually required for covering the operation area of the group. Traffic channels for the group call are also allocated from such 'extra' base stations. This solution, however, leads to inefficient use of traffic channels in the system and may even be impossible in some systems for lack of traffic channels.

The object of the invention is a method for setting up regional group calls without the above-mentioned disadvantages.

Disclosure of the Invention

This is achieved with a method such as disclosed in the introductory paragraph. According to the invention, this method is characterised by transmitting an additional group call paging message via fixed radio stations of radio cells adjacent to said predetermined operation area to the mobile radios of the

group, said additional group call paging message containing an instruction to switch to the traffic channel of the radio cell residing in said operation area, which traffic channel is allocated to the specific group call.

The idea of the invention is to allocate traffic channels to a group call only at those fixed radio stations whose coverage area is sufficient to cover the operation area of the group concerned, whereas at fixed radio stations of the radio cells abutting on the operation area a group call paging message is transmitted containing an instruction to switch to one of the traffic channels allocated in the operation area. This is a sure way of reaching also such members of the group that are in the peripheral zones of the operation area and that are in radio connection with a fixed radio station outside the operation area. In addition, the method utilises the traffic channels of the system efficiently.

Brief description of the drawing

In the following the invention is described in more detail by means of an embodiment with reference to the attached figure, which illustrates a radio system in which the invention may be applied.

Detailed description of the Invention

The figure shows a mobile radio system in which the geographical area covered by the system is divided into smaller radio areas or radio cells C1, C2 and C3 so that adjacent cells have preferably overlapping peripheral areas. Specific radio frequency channels have been assigned to each cell for speech connections so that at least neighbouring cells have different frequencies. Each cell C1, C2 and C3 has at least one fixed multichannel transceiver equipment BS1, BS2 and BS3, called a base station herein. All the base stations

BS1, BS2 and BS3 are coupled to a mobile exchange MX, which controls the operation thereof.

For control signalling, such as call set-up signalling, in the system either each base station has an individual radio frequency channel as a control channel or a plurality of base stations BS1, BS2 or BS3 have a common radio frequency channel as a control channel. The common control channel is used by the base stations BS1, BS2 or BS3 sequentially on a time-shared basis for transmitting their control messages. In the latter case the system may comprise a plurality of base station groups, each having their own control channel. The transmission sequence starts from a given base station and terminates in a pause before the sequence starts again with a transmission from the same base station. In the preferred embodiment of the invention, control signals or bursts transmitted on the control channel comply with mobile radio signalling according to the MPT standard 1327 issued by the British Department of Trade and Industry (DTI). Thus each burst is preceded by a pause during which none of the base stations BS transmits on the control channel. Each burst contains a frame which begins with the fields LET, PREAMBLE and SYNC, as specified in the MPT standard 1327, chapter 3.3.3.1. Each burst is also marked with the identifier of the transmitting base station.

One or more mobile transceivers, i.e. mobile radios MS1 - MS5 roam freely within the area of the mobile radio system. Each mobile radio MS must be registered with one of the base stations when roaming within the system. In this way the system keeps a register on the rough location of the mobile radios MS for call set-up procedures. The mobile radios MS are allowed to roam freely from one cell C to another but they have to register with the base station BS of the

new cell C on transition. The mobile radio MS is considered to be active in the cell C when the telephone has selected the cell in accordance with a predetermined procedure, the base station BS of the cell has transmitted a burst and the mobile radio MS has received the identifier of the base station. Said selecting procedure can be based on the strength of the signal received from the different base stations BS and on the quality of signalling in view of the mobile radio MS. Such registering is not, nevertheless, an indispensable feature for the invention.

Normally the system sets up a call between the mobile radio MS and another mobile radio or a subscriber of a public switched telephone network PSTN. A call to a given mobile radio is set up by dialling the subscriber number of the mobile radio. In group calls the whole group is called with a single dialled number, i.e. a group number. A group call is a conference call in which all participants may talk in turn and hear one another. An individual mobile radio may belong to a plurality of groups programmed into the mobile radio. The system keeps a file on the base stations associated with the group number of each group. A group call may cover one, several or all base stations within the area of a mobile exchange or a plurality of mobile exchanges.

When the user wishes to make a group call, the mobile radio transmits a signalling message indicating at least that the request concerns a group call and the group number of the desired group. In general the message contains the subscriber number of the subscriber A as well.

In general it is the mobile exchange MX to which the base stations BS are coupled that reacts to the signalling message. On the basis of the group number the exchange MS retrieves from its register information

on which base stations BS belong to the operation area of the group call concerned. The exchange MX allocates the traffic channels from said base stations, queuing for a channel if a free channel is not immediately available.

When the channel is allocated at a given base station BS, the exchange MX transmits, on the control channel of this base station, to the mobile radios of the group an instruction to switch to the call on the allocated channel. If the mobile radio identifies the group number contained in the group call paging message, it switches to the traffic channel indicated by the group call paging message. In principle it is thus possible for a mobile radio to join a group call if it is located within the predetermined operation area of the group.

In a mobile radio system operating on a cellular principle, adjacent base stations BS often have considerably overlapping coverage areas (radio cells), such as radio cells C1 and C2 in the figure. Mobile radios MS2 and MS4 roaming in the overlapping area C' of the coverage areas C1 and C2 of two base stations BS1 and BS2 may use either one of the base stations BS1 and BS2. As regards a group call, the situation is problematic if one base station BS1 is located within the predetermined operation area of a given group and the other base station BS2 outside it.

Let us assume that a group call is set up in the overlapping area C' of the coverage areas C1 and C2, and the mobile radio MS2 uses the base station BS1 and MS4 the base station BS2. If the group call paging message is transmitted through the base station BS1, only MS2 receives the group call paging message through the base station BS1 and joins the group call, although

in principle both mobile phones are situated in the operation area allocated to the group, i.e. area C'.

The invention resolves this problem in such a manner that a group call paging message is transmitted from the base stations BS of radio cells abutting on the predetermined operation area of a group having a given group call number. This group call paging message contains the group call number and an instruction to switch to the traffic channel of a radio cell in said operation area which is allocated to the group call in question. At these 'outside' base stations no traffic channel is allocated to the group call.

The method can be illustrated by means of an example pertaining to the figure. Let us further assume that the base station BS1 resides within the predetermined operation area of a given group and the other base station BS2 outside it. It is still further assumed that a group call is set up in the overlapping area C' of the coverage areas C1 and C2, and the mobile radio MS2 utilises the base station BS1 and MS4 the base station BS2. In accordance with the invention, the base station BS1 allocates a traffic channel to the group call and transmits a group call paging message containing the group call number and an indication of the allocated traffic channel. MS2 receives the group call paging message transmitted by BS1 and joins the group call by switching to the traffic channel in question. The base station BS2 does not allocate a traffic channel but transmits a group call paging message containing a group call number and an instruction to switch to the traffic channel allocated by BS1. MS4 receives the group call paging message transmitted by BS2 and joins the group call by switching to said traffic channel of BS1. The invention thus ensures that all mobile phones just barely within the

range of audibility of BS1 are included regardless of whether they are initially in contact with BS1 or BS2.

The only disadvantage in the method of the invention is that the mobile radios of the group beyond the range of audibility of BS1 (the coverage area of the group call), such as MS5, may receive the group call paging message transmitted by BS2 instructing to switch to the traffic channel of BS2. A group call is not, however, usually possible for these mobile radios.

Depending on the operation of the mobile radios, a weak connection is established, or a connection on which nothing can be heard (or mere noise), or the mobile radio releases the connection automatically on detecting that the requirements for a connection are not satisfied. All the above-mentioned mobile radios may be used in connection with the invention but the last mentioned is most preferred. The user receives an indication that a group call has been attempted but he himself is outside the coverage area.

Applying the invention requires only a few modifications to the existing procedures. In the preferred embodiment of the invention the method is realised without any modifications to the mobile radios. This has been possible, because the signalling messages between the mobile exchange and the mobile radio already contain the information required for the method.

The operation area of each group call is defined with regard to the mobile exchange MX in such a manner that for each base station there is a list of the adjacent base stations through which a group call paging message is also to be transmitted. Alternatively, these 'adjacent' base stations may be listed for each group. In group call set-up, the mobile exchange MX retrieves the 'adjacent' base stations thus defined from

its register and transmits a group call paging message on the signalling channels of these as well.

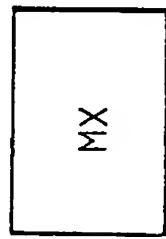
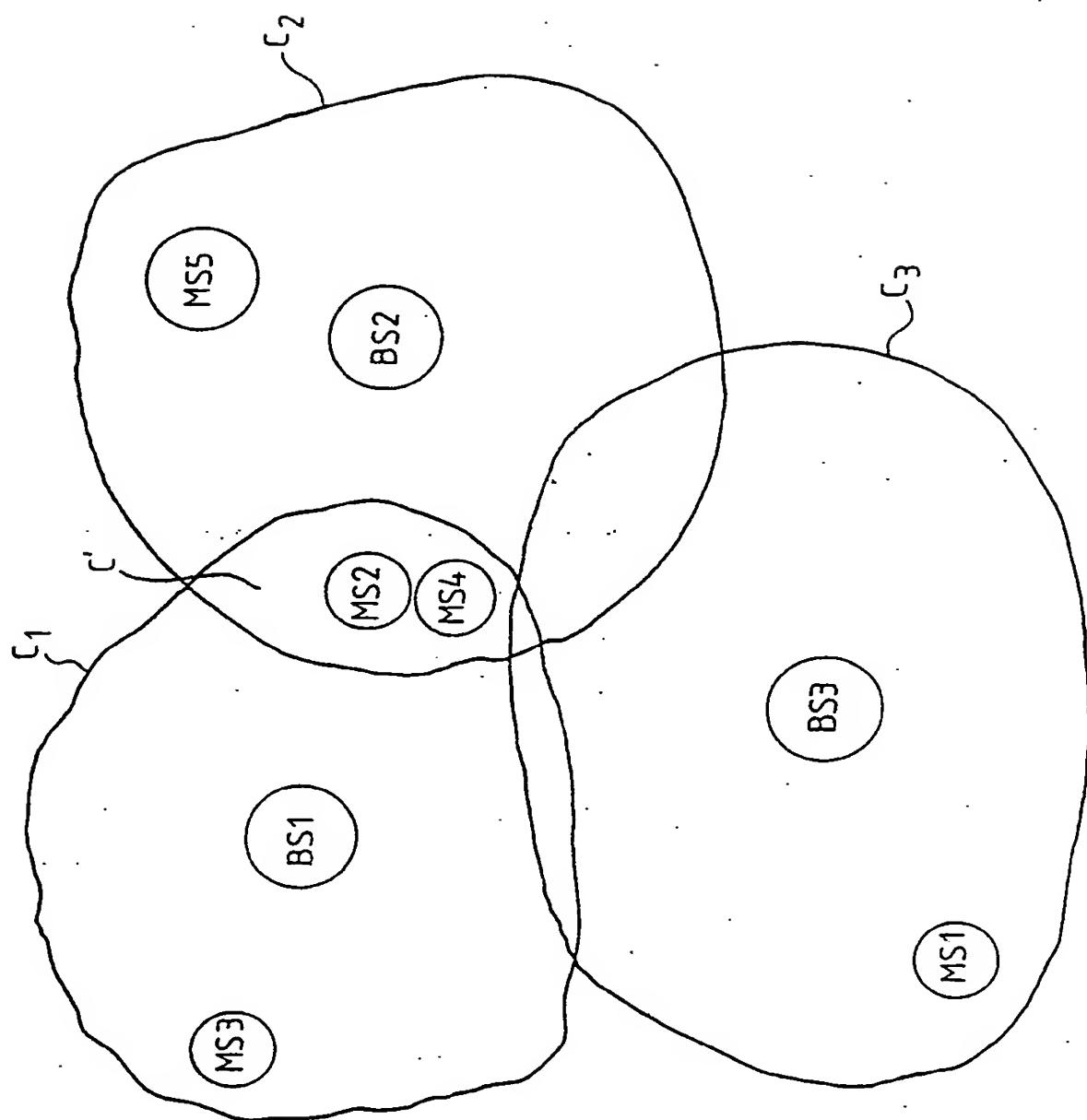
Although the embodiment given by way of example is based on the centralised control of the mobile exchange MX, the invention may also be applied in a decentralised environment, e.g. in a case where the base stations are located within the area of a plurality of exchanges. The method may also be applied without the exchange MX, in which case the realisation is based on the intelligence and mutual co-operation of the base stations.

The figure and the associated description are merely intended to illustrate the present invention. In its details the radio system according to the invention may vary within the scope of the attached claim.

Claims

1. A method for setting up a group call in a cellular radio system, said system comprising a plurality of radio cells (C1-C3) with overlapping peripheral areas (C'), each radio cell comprising a fixed radio station (BS1-BS3) communicating by radio with mobile radio stations (MS1-MS5) roaming in the system, the method comprising allocating a traffic channel to the group call and transmitting a group call paging message containing said traffic channel indication via each fixed radio station (BS1) whose radio cell (C1) resides in a predetermined operation area of a called group to the mobile radio stations (MS1-MS5) of the group, characterised by transmitting an additional group call paging message via fixed radio stations (BS2) of radio cells (C2) adjacent to said predetermined operation area to the mobile radios (MS4, MS5) of the group, said additional group call paging message containing an instruction to switch to the traffic channel of the radio cell (C1) residing in said operation area, which traffic channel is allocated to the specific group call.

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INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 92/00230

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)⁶

According to International Patent Classification (IPC) or to both National Classification and IPC
IPC5: H 04 Q 7/02, H 04 B 7/26

II. FIELDS SEARCHED

Minimum Documentation Searched⁷

Classification System	Classification Symbols
IPC5	H 04 Q, H 04 B

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in Fields Searched⁸

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹

Category ¹⁰	Citation of Document ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	DE, A1, 3130408 (SIEMENS AG) 17 February 1983, see abstract; figures 1,2; claim 1 --	1
A	DE, B1, 2659656 (SIEMENS AG) 8 December 1977, see figures 1,2; claim 1 --	1
A	US, A, 4682367 (J. CHILDRESS ET AL) 21 July 1987, see column 1, line 16 - line 29; abstract; figures 1,2 --	1
A	GB, A, 2173377 (INTERNATIONAL STANDARD ELECTRIC CO) 8 October 1986, see abstract; figure 6 -----	1

* Special categories of cited documents:¹⁰

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"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"Z" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

25th November 1992

Date of Mailing of this International Search Report

04-12-1992

International Searching Authority

Signature of Authorized Officer

SWEDISH PATENT OFFICE

Göran Magnusson

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.PCT/FI 92/00230**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on **30/10/92**.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A1- 3130408	83-02-17	NONE	
DE-B1- 2659656	77-12-08	NONE	
US-A- 4682367	87-07-21	NONE	
GB-A- 2173377	86-10-08	NONE	

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